

# **WATER RESOURCE PROTECTION AND WATER POLLUTION CONTROL FOR THE HUAI RIVER BASIN**

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The Huai River basin is situated in the hinterland part of China, along a zone of transition between China's southern and northern climates. Through about fifty years of management and development, the basin has now become a main base for producing commodity food grain, cotton and oil, playing an important strategic role in China's modernization construction.

Since the 1980s, water pollution across the Huai River basin has been increasingly severer and this situation has aggravated the serious contradiction between water supply and demand. The lack of water resource has become a major constraining factor for the sustainable, rapid and normal development of the basin's economy. Water resources protection and water pollution control have been the critical problems for sustainable use of water resource in the basin.

## **1. GENERAL DESCRIPTION OF WATER RESOURCES IN THE BASIN**

1.1 The Huai River basin is located between the Yellow River and Yangtze River. The whole basin covers 34 cities and towns and 182 counties of the four provinces of Henan, Anhui, Jiangsu and Shandong, with a total catchment area of 270 thousand km<sup>2</sup>. The basin has two large water systems: Huai River and Yi-Shu-Si with catchment areas respectively of 190 thousand and 80 thousand km<sup>2</sup>. The two water systems are connected by the Grand Canal from Beijing to Hangzhou and the Huai River-Shu New River. The Huai River originates from the Tongbai mountain in Henan province and then flows east across Henan, Anhui and Jiangsu provinces before flowing into the Yangtze, with a total length of 1000 km. The Yi, Shu and Si Rivers rise in the Yimeng Mountainous area and pass through Jiangsu province before discharging into the Yellow Sea via Yi River and New Shu River.

The water systems of Huai River basin are very complicated with numerous tributaries and most of them flow across several provinces. The Huai River has 120 primary tributaries and the Yi-Shu-Si has 117.

1.2 The Huai River basin is located in the zone of transition between wet



among which for irrigation accounted for 73.5%, that for forestry, livestock farming and fishery 4.3%, industrial 13.5% and domestic 8.7%.

## 2. WATER QUALITY AND WATER POLLUTION

2.1 The results of monitoring operations performed at outlets for waste discharge into rivers in 188 cities and towns within the basin have shown a total wastewater discharge from the whole basin by the end of 1997 of 3.537 billion tons and an annual discharge of major pollutants (COD) of 11.67 billion tons. The water pollutants have come mainly from industrial wastewater and household sewage.

2.1 Based on the water quality data recorded in 1997 in accordance with the National Surface Water Environmental Standard (GB3838-88), the results of survey on water quality carried out during low water periods along river sections of 3,243 km in the Huai River basin may indicate the situation as follows:

Standard of water quality	Water quality description	Percentage of river section length
Category I	best	0
Category II	Good	3%
Category III	Middle	19.1%
Category IV	Polluted	12.8%
Category V & above	Seriously polluted	65.1%

2.3 Water pollution has aggravated the contradiction between water resource supply and demand and led to pollution-related water shortage. The results of random sampling on water supply carried out in 1990-1992 in 18 cities and towns across the Huai River basin have indicated that 10 cities are of resources-related water shortage accounting for 55.6% and 8 cities pollution-related water shortage accounting for 44.4%.

2.4 The results of monitor performed in 1998 at 31 sections of provincial boundary along 30 inter-provincial rivers have demonstrated the following:

Cross Sections (%)	Water quality
45.2%	Above Category V
16.0%	Category V
32.3%	Category IV
6.5%	< or = Category III

## 3. PROTECTION AND MANAGEMENT OF WATER RESOURCES

3.1 The Chinese government pays great attention to water resource protection and water pollution control for the Huai River basin. In 1977, the Huai River Conservancy Commission of the Ministry of Water Resources was authorized by the State Council to be responsible for the water resource protection for the basin and at the same time the Bureau of Huai River Water Resources Protection was established. In 1988, the Leading Group on Water Resources Protection for the Huai River Basin was formed to reinforce water resource management and water pollution control for the Huai River.

In August 1995, the State Council published the Provisional Guidelines on Water Pollution Prevention and Control for the Huai River and in June 1996 approved the Program of Water Pollution Prevention and Control for the Huai River and Ninth Five-Year-Plan (hereinafter referred to as Program and Plan). In these documents, some objectives were established for coming up to the indexes on discharging industrial polluting materials in 1997 and for making water clear by the year 2000 for the Huai River basin. On the basis of the above requirements, the four provinces within the basin and several ministries and commissions of central government prepared plans of action to distribute between them and accomplish all improvement indexes.

3.2 In compliance with the requirements of the above documents, two systems of combining basin management and regional management were adopted for the protection of water resource of the Huai River, concession system for water use and total volume control system for waste discharge.

(1) Concession system for water use

The Regulations for Implementing the Concession System for Water Use approved by the State Council clearly define that all water uses by any organization or individual from rivers, lakes or underground aquifers either through hydraulic structures or by water lifting mechanical devices must be made on submission of written application to the competent authorities for water administration. These uses will be permitted only after granting a water concession. The water concessions define for the users not only the monthly quantity of water use, but also the quantity and quality required for water return (including type, concentration and total volume of pollutants). Violations such as excess water use, pollutants content in returned water beyond the limit and total volume exceeding indexes of control shall be punished with fines. The competent authorities for water administration shall have the right to reduce and limit the water uses for concession holders and in the cases of serious violation the concessions of the users may be revoked.

(2) Total volume control system for waste discharge

The above Guidelines have indicated that the government must implement

Program and Plan have required to limit the maximum permitted discharge of COD to 890 thousand tons by the end of 1997 and to 368 thousand tons by the year 2000. In addition, the maximum permitted COD discharge during different periods has been determined for all related provinces. After that, the governments of these provinces have prepared their own plans of total volume control for waste discharge and then total volume control indexes for waste discharge have been resolved into the indexes of local governments at different levels. All governments at higher level than county have developed and implemented their own regional plans of water pollution control and plans of total volume control for waste discharge. The governments of higher level have supervised the fulfilment of assigned tasks. Generally, the water protection authorities of the basin shall be responsible for supervising the compliance status with the total volume control system for waste discharge.

Double-direction control has been maintained over the key enterprises of waste discharge. It means that not only waste discharge concentration must be less than the maximum permitted discharge concentration but also the pollutants of waste discharge must be less than the permitted volume for waste discharge.

#### **4. PROGRESS OF WATER POLLUTION CONTROL AND EXISTING PROBLEMS**

4.1 The Chinese central government and the State Council have attached great importance to the Huai River's water pollution control and this task of control has been put in the first place for the plan of managing "Three Rivers" and "Three lakes" and this has significantly improved the Huai River's water pollution management. By the end of June 1996, 1,111 small paper mills with an annual production of less than 5000 tons within the basin have been closed down; by the end of September of the same year, 3,876 small enterprises such as small chemical plants, small tanneries, small chemical fertilizer plants and other small plants have also been closed. By the end of 1997, among the whole basin's 1,562 enterprises with daily wastewater discharge of more than 100 tons, 1,139 have successfully achieved the goal of safe discharge. The situation of control by the end of 1997 may be summarized in the following:

Number of enterprises	Situation of control	Percentage
1,139	Achievement of the goal of safe discharge	72.9%
215	Production stopped	13.8%
190	production changed	12.3%

4.2 Early in 1998, a thorough inspection was carried out for the waste discharge into rivers from 169 cities and towns at higher level than county which had included in the above-mentioned Program and Plan. The results of monitoring activities had showed that a waste discharge from the Huai River basin 3.345 billion tons/year, which was reduced by 335 million tons/year in comparison with that of 1993. The discharge of COD was 1.0488 million tons, reduced by 0.4526 million tons/year in comparison with that of 1993, with a rate of reduction of 30.10%. It follows from the above-mentioned figures that significant success has been achieved in 1997 in relation to the safe discharge of industrial pollutants.

4.3 Since 1998, the Huai River basin's water pollution prevention and control enter the second stage that has required, by controlling major industrial pollutants and building 52 municipal wastewater treatment plants, reducing the total discharge of COD pollutants to 368 thousand tons/year. By the end of 1998, two wastewater treatment plants, Xuzhou and Zaozhuang, were built and other 24 were under construction and another 26 were in the course of preliminary preparations. Some projects are already completed the preparation and may be put into operation soon.

## **5. WATER POLLUTION PREVENTION AND CONTROL AND WATER RESOURCES PROTECTION WITH BASIN AS THE KEY LINK**

The approach to water pollution prevention and control and water resource protection with basin as the key link has had marked success during the period of recent five year management practice. The main experience is as follows:

5.1 Combination of efforts by the related central governmental authorities with provincial governments and commissions: A leading group has been formed which comprises several high-level leaders from the above-mentioned in order to strengthen the leadership for basin management, develop preferential policies, raise management funds and propose advanced technologies to ensure successful implementation of waster discharge control operations.

5.2 Unified planning: Carry out the total volume control system for waste discharge, accomplish assigned indexes of waste discharge for different levels and units and execute controls according to unified requirements.

control waste discharge according to law, carry out control measures within the limits of the whole basin and complete unified control activities and indexes before the unified deadlines to give energetic support to waste discharge control.

5.4 Two systems of water use concession and waste discharge permission have been implemented simultaneously within the basin both by water resource authorities and environmental protection departments.

5.5 Combination of basin management with regional management: To institute the river commissions into the monitoring centers, information centers and dispatching centers and carry out regulation of water quantity and quality in a unified manner by organizing inter-provincial combined pollution control activities.

## **6. The RIVER COMMISSIONS HAVE PLAYED AN IMPORTANT ROLE IN PROMOTING WATER POLLUTION CONTROL AND WATER RESOURCES PROTECTION. THE MAIN ACTIVITIES THEY HAVE COMPLETED ARE THE FOLLOWING:**

6.1 To be strict with practicing the water use concession system and strengthen water resource management in order to maintain control over them in a radical manner; prohibit water uses without water concession and over-exploited water use; maintain control over the quality of returned water; limit water use and even revoke water use concessions for those enterprises who cannot reach discharge norms before the specified deadlines.

6.2 Strictly control the quality of water flowing out of the provincial boundaries.

For 31 major inter-provincial rivers the sections of boundary are required to undergo water quantity and quality measurements once every month in order to determine the main pollutants content and the dynamics of concentration at these sections. In the cases of water quality exceeding the permitted values, it is needed to notify local governments and make measures for control immediately.

6.3 Unified management for water quantity and quality in some sensitive areas.

A combined prevention and control of water pollution during low water period has been carried out on the main stem of Huai River-Shaying river by water resource authorities and environmental protection departments of the Henan, Anhui and Jiangsu provinces. Based on the waste absorbing capacity in related areas during low water period, some solutions for limiting

quality along the river, proper regulation for sluice gates has been done to avoid some seriously polluted water discharge downstream to lower reaches for mitigating the pollution situation in downstream areas. In the serious degradation of water quality, some measures for limiting industrial pollutants discharge have to be adopted to improve the situation of waste discharge.

6.4 The Guidelines stipulate that inter-provincial water pollution disputes within the limits of Huai River basin shall be resolved by the basin's Department of Water Protection which shall propose resolution methods. Over the recent five years, a great number of activities have been completed for the resolution of inter-provincial water pollution disputes. For example, in July of 1994, there has been a serious pollution on the middle reaches of the Huai River and, on 4 January 1998, another serious pollution with the running water of Xuzhou city. In these cases, the basin's Department of Water Protection had immediately sent specialists to the site for performing monitoring operations and analysing the situation of water and waste to provide better basis to the basin's leading group on water resource protection for the successful resolution of these water pollution disputes.

6.5 Monitor waste discharge outlets into rivers, determine the whole basin's discharge volume of pollutants and implement effective supervision over the compliance status of the system of total waste discharge volume control. Early in 1998, the results of monitoring operations carried out at all waste discharge outlets of the whole basin's 169 cities and towns had demonstrated the success of the first stage's water pollution control for the Huai River basin and the efficiency of waste discharge reduction for the four provinces related to the basin. These results have provided accurately recorded data for the fulfilment of the second stage's tasks on pollution control and for making clear the water of the Huai River.

## **7. MAIN EXISTING PROBLEMS IN WATER RESOURCES PROTECTION AND WATER POLLUTION FOR THE HUAI RIVER**

7.1 The rate of water resource utilization is low and the waste of water is large:

---- Water use management is poor with serious waste, particularly in relation to the agricultural water use of 70-80%, with large portion of flood irrigation, serious filtration and low rate of water utilization;

---- ground water is seriously over-exploited. Among the 18 cities with water shortage in the Huai River basin, approximately two third of them always rely upon ground water. With growth of these cities and increase of their water use, ground water levels decline sharply forming a funnel.



7.2 The total waste discharge volumes in some cities and towns cannot be controlled yet and the situation of water pollution in the basin is still pressing:

---- The results of monitoring operations performed by the end of 1998 at 182 waste discharge outlets in areas of 46 cities and towns have indicated that the discharge of COD<sub>Cr</sub> for the half of these cities and towns has still increased compared with that of 1997;

---- The pace of municipal wastewater treatment plant construction is relatively slow. It is considered by the officers of the Ministry of Construction that among 52 municipal wastewater treatment plants included as the key projects in the Ninth Five-Year-Plan, half of them has not been under construction and it will be very difficult to reduce the discharge of COD to 368 thousand tons as specified in the above "Program and Plan".

## **8. Main counter-measures for water resource protection and water pollution control**

Working from the actual situation of the basin, the general idea for water resource protection and water pollution control may be summarized as follows: adhere the policy of simultaneous attention to water saving, development, protection and management; make integrated precautions of economy, technology, administration, and law etc. and realize overall planning, optimal allocation, total control and unified control of water quality. The main counter-measures are the following:

8.1 Water saving: Raising the rate of water utilization is one of the most important, continuing and fundamental policies for improving situation of water resource shortage. The most important is to save agricultural water uses. In 1997, the water use for irrigation for the Huai River basin was 42.297 billion m<sup>3</sup>/year, accounting for 73.5% of the total. If irrigation uses are decreased by 10%, a water volume of 4.2 billion m<sup>3</sup>/year will be saved. Therefore, introduction of advanced water saving irrigation technology is of major importance.

8.2 Make good the integrated program on development and utilization of water resource for the Huai River basin, realize optimal allocation of water resource and overall planning of the rational allocation of water resource for the Yangtze river, Huai River and the Yellow river and envisage the possibility of delivering Yangtze River water to the Huai River basin, especially during dry years.

8.3 Follow the principle of simultaneous construction of large-, middle- and

diversion, retention and lifting and regulate run-off distribution in time and space, as well as in geographic distribution in order to utilize water resource efficiently:

---- to realize the integrated program for the development of the Huai River basin, built large numbers of mountainous reservoirs in areas of upper reaches, improve and reinforce defective and dangerous reservoirs to make the most benefit of these reservoirs;

---- to remove obstacles, buildings and cultivated lands for restoring the original storage capacity of lakes and wet-lands;

---- to improve the work on soil erosion control and give energetic support to construction of agricultural water conservancy projects.

8.4 Reducing waste discharge is one of the radical measures for the improvement of environment. The following work shall be made good for speeding up waste discharge control and strengthening water management:

---- Raise funds in every possible way both domestically and from overseas to speed up the construction of municipal wastewater treatment plants and control of industrial pollutants;

---- Intensify law enforcement, all small enterprises which were already closed but are newly reopened by themselves shall be punished with heavy fines and, if the case is more serious, the responsibility for a crime shall be investigated and affixed;

---- The total waste discharge volume control system must be implemented strictly and it is necessary to properly control waste discharge into rivers, lakes, reservoirs, etc. It is needed to determine the quality criteria for the water flowing out of the boundaries of various administrative regions and put it under the supervision of the authorities of higher level. For those cities and towns with total waste discharge beyond the limits any new projects of industrial construction will be not allowed to be built. For these projects which have already been under construction the pollution control measures must be strictly envisaged;

---- Strengthen management functions for River Commissions

(1) With basin as the key link, realize unified management for water quality and pay attention to maintaining a rational ecological flow in the rivers of sluice gate;

(2) Develop the program of functional areas for water resource, investigate environmental capacity for these functional areas respectively at high, middle and low water flows, determine the limits of total waste discharge and establish the criteria of discharge limit and measures of supervision and control;

(3) Create Huai River's water quality models, improve water quality forecast, organize combined prevention and control for waste discharge and

(4) Establish water quality criteria at provincial boundaries and corresponding measures for its control and create related mechanism of economic compensation for pollution losses in lower reaches incurred by excess waste discharge in upper reaches.